THE UNHEALTHY NUTRITION OF PREGNANT WOMEN AND ITS EFFECTS

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Abstract

Enviromental chemicals or an inadeqate diet of the future mother can have serious consequences on the baby's health.

Maternal obesity is linked with abortion, stillbirth, preterm delivery as well as an increased rate of birth defects. Studies suggest that the exposition to trans fatty acids (TFA) during gestation and lactation can have harmful consequences to the offspring in adulthood such as predisposition to develop cardiovascular and metabolic diseases.

It is well-known that fish is very nutritious and important to be consumed by general public as well as by pregnant women. Unfortunately, fish can also have some unhealthy contaminants, such as mercury, a contaminant that can affect especially the nervous system of the fetus.

Smoking during pregnancy is harmful and can lead to abortion in the first trimester, premature placenta abruption, preterm delivery, stillbirth, decreased birth weight and sudden infant death syndrome

Alcohol can cross the placental barrier, thus entering the fetus' bloodstream. The Fetal Alcoholic Syndrom (FAS) consists of birth defects that occur in the womb as a result of alcohol exposure before or during pregnancy.

There has been no evidence of the teratogenic effect of caffeine yet, still pregnant women are advised to be cautious when consuming caffeine-containing foods and drinks, especially in the first three months of pregnancy.

Additives can be found in most aliments but their safety takes on new importance when referring to pregnant women: some may contribute to water retention (Monosodium Glutamate), others may deplete the body of vitamins or increase some digestion problems that pregnant women experience (Olestra).

During pregnancy, all actions that the future mother take reflect on the fetus. One way of having a healthy child and improving one's own health is to have a healthy diet.

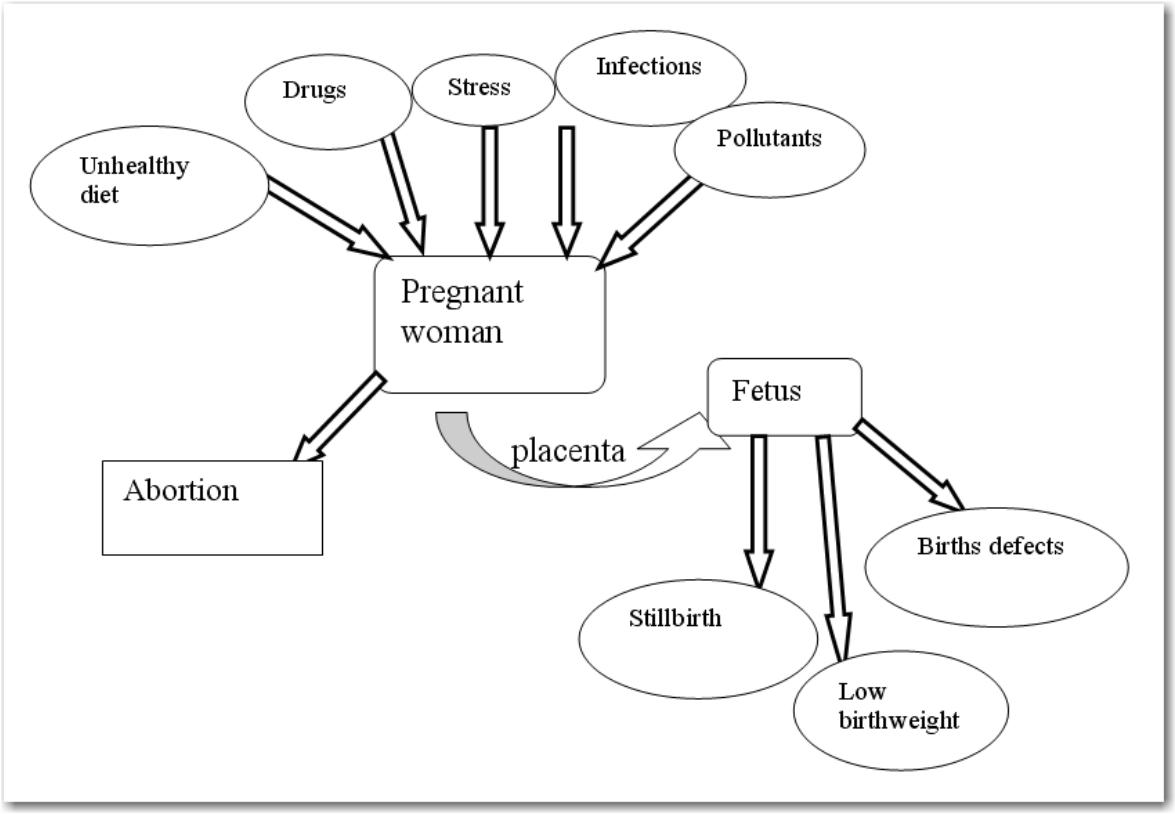
Key words*: pregnancy, diet, fetus, birth defects.*

Fetuses are extremely susceptible to outside influences such as the mother's diet or the enviromental chemicals. Infections, stress, pollutants or an inadecvate diet of the future mother can have serious consequences on the baby's and future adult's health.

This theory, called fetal programming, postulates that babies receive more from their

parents than their genes; they may be born with a tendency to develop diseases based on what their mothers were exposed to during pregnancy.

A healthy diet is crucial during pregnancy. Good nutrition is essential to ensuring that a mother's body can provide the baby with all the nutrients it requires to develop and grow into a healthy adult.



Maternal obesity and "fast-food" products

Maternal obesity is associated with an increased rate of birth defects. The chances of having neural tube defects (among them, spina bifida being the leading cause of childhood paralysis) are double in the newborns of obese mothers compared to those of normal weight mothers (1).

Other anomalies (1, 2) that are frequent among mothers with obesity are:

• cardiovascular anomalies (especially septal anomalies) 30% more frequent in obese mothers' newborns than in non-obese mothers' newborns

• cleft palate with/without cleft lip 20% more frequent in obese mothers' newborns than in non-obese mothers' newborns

• hydrocephaly 60% more frequent in obese mothers' newborns than in non- obese mothers' newborns

• limb reduction anomalies

• anorectal atresia.

Maternal obesity is linked with abortion, stillbirth, preterm delivery, neonatal death, and delivery of an extremely low birth weight of infant.

A study carried out at Royal Veterinary College, London proved that pregnant rats that were fed a diet rich in fat, sugar and salt exposed the offsprings to the risk of overeating and becoming obese adults, also having a preference for the same type of food.

This study, published in the British Journal of Nutrition, was made on a population of pregnant rats fed a diet of processed food such as: doughnuts, muffins and biscuits during pregnancy and lactation. The offsprings had the tendency to overeat and had a clear preference for the same type of food rich in fat, sugar and salt when compared to offsprings of rats which had been given regular feed. In addition, they had high levels of triglycerides, cholesterol, blood glucose and, studied until they reached maturity, they turned out to weight more than those in the control group (3).

In conclusion, the exposure of the fetus to a maternal unhealthy diet, might help explain the preference some adults have for "fast-food" products and sweets, even when they can choose a healthy diet (3).

Hydrogenated vegetable oil

During pregnancy, changes in the maternal metabolism occur in order to provide a good nutrition to the fetus. Lipids play an important role in fetal development. Although lipids transfer through placenta is limited, any changes in the mother's diet concerning fatty acids can influence the fetal and postnatal development (4).

Metabolic programming occurs during the intrauterine period. Inadequate nutritional and environmental factors may alter it and have serious consequences, such as predisposition to develop cardiovascular and metabolic diseases (5, 6).

Studies suggest that the exposition to trans fatty acids (TFA) during gestation and lactation can have harmful consequences to the offspring in adulthood (7). The levels of TFA in maternal milk are directly correlated to the maternal diet during gestation and lactation (7).

To support this, a study was carried out at São Paulo Federal University, Department of Physiology, in 2007, trying to establish whether feeding a diet enriched with partially hydrogenated vegetable oil rich in trans fatty acids to a population of pregnant female rats, will modify the offsprings' serum lipid profile and the gene expression of adipokynes involved with insulin resistance and cardiovascular diseases. This study concluded that the offsprings exposed during gestation and 90 days after they were born to this diet rich in trans fatty acids had increased levels of insulin, adiponectin and epididymal adipose tissue PAI-1 mRNA compared to the offsprings in the control group. In addition to this, the offsprings exposed in the womb to this diet rich in trans fatty acids, but fed the control diet after they were born, also had an increased level of epididymal adipose tissue PAI-1 mRNA(8).

It seems that these conditions are produced by metabolic programming resulting from early exposure to dietary hydrogenated fat. This had harmful consequences, even after the withdrawal of the causal factor (8).

Fish Products

It is well-known that fish is very nutritious and important to be consumed by general

public as well as by pregnant women. Fish contain essential nutrients such as: omega-3, B vitamins and proteins.

Unfortunately, fish can also have some unhealthy contaminants, such as mercury, a contaminant that can affect especially the nervous system.

The FDA (Food and Drug Administration) has released guidelines regarding the quantities of fish considered safe to be consumed by children, women who are pregnant and those who are trying to become pregnant: no more than 340g of "low mercury" fish (anchovies, calamari, caviar, crab, herring, clams, oysters, sturgeon, cod, tuna, carp) should be consumed weekly and no more than 3 servings of 170g of "high mercury" fish (sea trout, lobster) should be consumed per month. "Highest mercury" fish (shark, mackerel, swordfish) should be avoided during pregnancy and lactation (information from the following source: Natural Resources Defense Council www.nrdc.org).

Mercury exposure in the womb, which can result from a mother's consumption of fish containing mercury, can adversely affect the development of the baby's nervous system with impacts on cognitive thinking, memory, attention, language, and fine motor skills.

Biological monitoring performed by the Centers for Disease Control and Prevention in 1999 and 2000 have showed that most people have blood mercury levels below a level associated with possible health effects. As compared to adults, there are some factors that make the fetuses and newborns more susceptable to the effects of low levels of mercury exposure: low body weight, higher gastrointestinal absorption rate, less effective renal excretion, and a less effective blood-brain barrier (9).

The most common sources of maternal exposure to mercury are amalgam fillings and fish (10). The mercury is then transmitted through the placenta to the fetus (10, 11, 12).

Meconium level of mercury is the most reliable indicator of fetal mercury exposure. It often has significant levels even when there are low levels in mother's blood (13).

The highest levels of mercury are usually found in the pituitary gland of the fetus, this affecting the endocrine, immune, and reproductive systems (14). It is well-known the fact that mercury is an endocrine system disrupting substance. It accumulates especially in the pituitary gland, hypothalamus, and thyroid gland (15), interfering with enzyme production processes, glucose transfer, and other hormonal functions.

The human brain forms and develops over a long period of time and neuron proliferation and migration continues in the postnatal period. There is also postnatal activity in the development of receptors and transmitter systems as well as in the production of myelin. The blood-brain barrier is not fully developed until the middle of the first year of life. Depending on the time of exposure, many of the toxic substances such as mercury are known to damage the developing nervous system by interfering with one of these processes (16,17). The effects are: decreases in IQ, attention span, concentration and learning disabilities (15).

Infant head circumference was found to be negatively correlated to infant meconium mercury levels (13).

Prenatal/early postnatal exposure to mercury affects level of nerve growth factor

(NGF) in the brain, which has direct consequences on the development of the nervous system. Mercury's neurotoxicity may be the effect of inducing reactive oxygen species such as: superoxide ion, hydrogen peroxide, and hydroxyl radical causing enhanced lipid peroxidation, DNA damage and altered calcium homeostasis (16, 17). In conclusion, taking into consideration that fish is essential to a healthy diet because of its omega 3 fatty acid content and because of other nutritive elements, essential for the development of the infant, it all seems to be about „moderation". Pregnant women are advised to consume the recomanded quantities of the „low mercury" fish, avoiding the „high mercury" ones.

Food Additives

Additives can be found in most aliments, being used to make food last longer, improve its taste or cut calories. The safety of these substances takes on new importance when referring to pregnant women (18).

MSG (Monosodium Glutamate) is a sodium salt of glutamic acid. It is used to intensify and enhance flavor, but it may experience side effects such as: headache, dizziness, sleep disturbance, nausea, and vomiting after eating food containing MSG.

There is no evidence that MSG has any toxic effects on unborn babies; therefore, the Food and Drug Administration has classified MSG as: generally recognized as safe for consumption. However, MSG is very high in sodium and may contribute to water retention, that's why pregnant women that have this tendency must try to avoid aliments that contain it (19).

Olean, also known as Olestra, is a synthetic mixture of sugar and vegetable oil and is used as a fat substitute in some foods. Olean is passed through the body undigested, so it is not absorbed, does not enter the mother's bloodstream, and does not reach the babies' blood. However, olean has been shown to deplete the body of vitamins A, D, E, and K and, when eaten with any food containing carotenoids (such as beta-carotene in carrots or lycopene in tomatoes) these important nutrients are poorly absorbed. While olean does not harm the baby directly, the mother needs these vitamins in order to maintain a healthy pregnancy.

In addition, olean can increase some digestion problems that pregnant women usually experience: diarrhea and gastrointestinal discomfort.

Aspartame is an artificial sweetener found in most diet soft drinks and other sugar-free aliments, aspartame being approximately 200 times sweeter than sugar.

It is composed of two amino acids: phenylalanine and aspartic acid. The Food and Drug Administration has judged aspartame safe for the general public and it is considered safe to eat while pregnant. However, future mothers who have a genetic disease called phenylketonuria (PKU) should avoid it, because this condition makes the phenylalanine build up in their bodies, possibly causing their babies to be born with severe mental disabilities (20).

Saccharin was one of the first artificial sweeteners on the market. Saccharin can cross the placental barrier and enter the fetal blood stream. Although there are no conclusive data from scientific studies, it is believed it is harder for them to clear the saccharin from its

blood and the accumulation may increase the risk for bladder problems or even bladder cancer. The American Dietetic Association and the American Diabetes Association recommend that women should consume saccharin in moderation while pregnant.

Sucralose (Splenda) - according to the Food and Drug Administration, sucralose is safe for the general public to consume. However, there have been no specific safety studies concerning its safety in pregnant women and children.

Sodium Benzoate is used as a preservative, killing most bacteria and fungi. Moderately toxic in large amounts, it is known to cause rash and aggravate asthma on a predisposed ground.

Coffee

Caffeine is a strong stimulant of the central nervous system. It can be found in tea leaves and in coffee, cocoa, and kola beans. The discovery that coffee beans contain a substance that wards off sleep has been credited to residents of Arabian monasteries.

Moderate amounts of caffeine have different effects on the body: enables one to focus better, stimulates the brain, heart muscle, alters the metabolism of fat, dilates the blood vessels, and stimulates insulin to be released. Children are much more susceptible to the effects of caffeine, which usually makes them hyperactive and nervous.

As to pregnant women, they are allowed to have no more than 200mg of caffeine a day (21).

Average caffeine amounts in common foods and beverages (modified after Higdon, J.V., Frei) (22)

Common foods and beverages	Average caffeine amounts
1 cup of instant coffee	75 mg caffeine
1 cup of brewed coffee	100 mg caffeine
1 cup of tea	50 mg caffeine
250ml of cola	32,5 mg caffeine
250ml of "energy" drink	80 mg caffeine
50g of plain chocolate	50 mg caffeine
50g of milk chocolate	25 mg caffeine

Caffeine is a stimulant; it increases the heart rate and metabolism, thus affecting the developing baby. But while a constant high level of stress isn't healthy, brief periods of fetal stress, such as that the baby would feel after the mother drinks a cup of coffee, shouldn't affect it (23).

Regular consumption of coffee can be addictive and large amounts can also cause insomnia, nervousness and headaches. It's also a diuretic, which causes the body to lose excessively water and minerals, elements that are essential in order to maintain a healthy pregnancy.

Coffee can also diminish iron’s absorbtion if it is consumed with a meal or within half an hour of a meal.

In pregnant women, large amounts of caffeine were related to low birth weight in newborns.

In adition, caffeine was proved to induce birth defects in rats: injecting 100-200 milligrams of caffeine per kilogram of body weight into pregnant mice induced birth defects in 6 to 20 percent of the offspring. Also, oral intake of 100 to 150 milligrams of caffeine per kilogram, caused malformations in 8 to 20 percent of the fetuses. However, these dosages were quite high, equivalent to injecting into a woman caffeine contained in 50 to 100 cups of coffee, so there has been no evidence of the teratogenic effect of caffeine yet (23).

In conclusion, pregnant women are advised to be cautious when consuming energy-drinks, coffee, cola, chocolate or other caffeine-containing foods and drinks, especially in the first three months of pregnancy.

Smoking

It is well-known that smoking during pregnancy is harmful and can lead to miscarriage in the first trimester, premature placenta abruption, preterm delivery, stillbirth, decreased birth weight and sudden infant death syndrome (24).

Cigarette smoke contains approximately 2,500 chemical substances. It is not known exactly which one of these substances is harmful to the fetus, but nicotine and carbon monoxide are believed to play an important role. Among other effects, they are suposed to reduce the oxygen supply to the fetus, thus reducing its growth.

Infants born by mothers who smoke during pregnancy weight on 150-300g less than those born by non-smoking mothers and the chances of having small-for gestation fetus is double among women who smoke (25).

In 2004, in the United States of America, 11.9% of the babies born by mothers who smoked during pregnancy were of low birthweight (<2.5kg), compared to 7.2% of babies of nonsmokers (26).

Smoking is well-known to slow down fetal growth. In addition, it increases the risk of preterm delivery (before completion 37 weeks of pregnancy) (27). Low birthweight may be caused by poor fetal growth, preterm delivery or both (27).

The more a woman smokes during pregnancy, the greater is the risk for the fetus to have complications.

A recent study suggests that smoking during the first trimester of pregnancy and one month before conceiving increases the risk of having a baby with birth defects, especially cardiovascular anomalies. The risk is proportional with the number of cigarettes the future mother has smoked (28).

Smoking may increase the risk of premature rupture of the membranes, and doubles the risk of placental complications (29): placenta praevia, premature placenta abruption. It may reduce utero-placental circulation, causing hypoxia, with direct consequences on the development of the central nervous system of the fetus (30).

Studies showed that passive smoking in pregnant women also increases the risk of having a low birthweight baby, so they should avoid cigarette smoke altogether (27).

Alcohol

Alcohol can cross the placental barrier, thus entering the fetus' bloodstream, with

direct consequences upon its growth and development. The most vulnerable cells are the ones of the central nervous system (brain and spinal cord).

Large amounts of alcohol used during pregnancy can lead to abortion, early delivery or stillbirth (31).

The Fetal Alcoholic Syndrom (FAS) consists of birth defects that occur in the womb as a result of alcohol exposure before or during pregnancy (32):

- Facial anomalies: small head, narrow eye openings, short nose, thin upper lip, incomplete developed mouth, deformed ears. These traits become more obvious around two or three years old.
- Neurological anomalies: severe mental disabilities (IQ around 65), nervosity, behaviour problems, muscle hipotony, sensorial hipoacusy, learning and memory problems, the imposibility to focus, inpulsiveness.
- Hearing anomalies: late myelinization of the auditory nerve, Fallopian tubes anomalies. Hearing anomalies will determine language and comprehensive difficulties.
- Bones anomalies: deformed thoracic cavity and backbone.
- Other internal organs anomalies.
- Cardiovascular defects.
- Growth deficiencies: children that were exposed to alcohol in the womb are usually smaller than other children of the same age.

Fetal Alcohol Effects (FAE) include an ensemble of neurological anomalies attributed to prenatal exposure to alcohol. Children diagnosed with FAE don't necessarily have all the facial malformations of those with FAS and usually have a normal IQ. Their neuological anomalies manifest through: poor social interactions, problems at school, problems with the law at adolescence. All these have serious consequences on the teenagers and their families.

The effects of alcohol exposure on the fetus are influenced by:

- How much and how often the future mother drinks alcohol
- The stage of the pregnancy
- Substance abuse, smoking and other prior health problems of the mother
- Genetic predisposition-some babies are more vulnerable than others to the effects of alcohol (33)

How much alcohol is safe?

When a pregnant woman drinks, her baby does the same thing. Large amounts of alcohol damage the fetus severely but there is no evidence that small amounts don't have the same effect.

In conclusion, the best way to prevent FAS is not drinking at all during pregnancy.

Conclusions

During pregnancy, all actions that the future mother take reflect on the fetus. Mothers can either contribute to their baby's health or fail in making changes in their lifestyle that may have positive effects on both of them.

One way of having a healthy child and improving one's own health is to have a healthy diet.

Pregnancy is a very demanding time from the nutritional point of view. An adequate caloric intake, a healthy diet containing a well balanced percentage of proteins, lipids and carbohydrates, along with vitamins and

minerals from fresh vegetables and fruits as well as an active lifestyle will offer the infant the best start in life.

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